VERIFICATION OF TRANSLATION

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am the translator of the documents attached and I state that the following is a true translation to the best of my knowledge and belief of Japanese Patent Application No. 2002-059118.

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[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] PORTABLE INFORMATION TERMINAL AND PROGRAM

[WHAT IS CLAIMED IS:]

[CLAIM 1] A portable information terminal, characterized by comprising:

a rotation detection means for detecting rotation of a rotation body having a substantially disc-like shape;

a press detection means for detecting a press of said rotation body in a direction substantially perpendicular to an upper surface of said rotation body with a rotation axis of said rotation body as a fulcrum; and

a display control means for controlling display of an image,

and in that said display control means rotates and displays said image in accordance with the rotation of said rotation body detected by said rotation detection means and displays said image after switching a range of said image in accordance with a result of detection by said press detection means.

[CLAIM 2] The portable information terminal according to Claim 1, characterized in that:

said display control means controls displaying of a plane image as said image and displays said plane image after rotating in a counterclockwise direction or a clockwise direction about a center of said image in accordance with the rotation of said rotation body detected by said rotation detection means.

[CLAIM 3] The portable information terminal according to Claim 1, characterized in that:

said display control means controls displaying of a three-dimensional image in a virtual space as said image and displays said three-dimensional image after rotating in a horizontal plane in said virtual space setting a current position in said virtual space as reference in accordance with the rotation of said rotation body detected by said rotation detection means.

[CLAIM 4] The portable information terminal according to Claim 3, characterized in that:

said display control means scales up/down and displays said three-dimensional image corresponding to a position where said press detection means detects the press.

[CLAIM 5] A program executed by a computer which controls a portable information terminal having:

a rotation detection means for detecting rotation of a rotation body having a substantially disc-like shape;

a press detection means for detecting a press of said rotation body in a direction substantially perpendicular to an upper surface of said rotation body with a rotation axis of said rotation body as a fulcrum; and

a display means for displaying an image, said program is characterized by comprising the step of:

controlling displaying of said image in said display means; said step of controlling rotates and displays said image in accordance with the rotation of said rotation body detected by said rotation detection means and displays said image after switching a range of said image in accordance with a result of detection by said press detection means.

[DETAILED DESCRIPTION OF THE INVENTION]

[FIELD OF THE INVENTION]

[0001]

The present invention relates to a portable information terminal and a program, particularly a portable information terminal and a program with which various operations can be made more comfortably.

[BACKGROUND ART]

[0002]

In recent years, users have acquired and utilized various contents in portable information terminals such as mobile phones or PDAs (Personal Digital Assistants).

[0003]

This allows a user, for example, to enjoy an acquired game without limitations on locations or in time, and to acquire map data for use with a GPS

(Global Positioning System) function to check the current position of himself/herself.

[0004]

In this case, for example, control of behaviors of a main character a of the game or checking of a route to a destination on the map are typically performed by operating up, down, left, and right buttons provided on a terminal or buttons around them according to the situation.

[DISCLOSURE OF THE INVENTION]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

[0005]

In conventional terminals, however, individual buttons are provided independently to be spaced from one another, so that it is difficult, for example, to operate the terminal smoothly while it is held by a hand, presenting a problem that its operability is very poor when a game or the like is played.

[0006]

In addition, some are in the form in which a command is input by inclining a stick-like member slightly protruding from a surface of a housing in upward, downward, leftward, and rightward directions. However, the stick-like member causes an entry which does not necessarily reflect an intention of a user accurately, for example, although the user manipulates it with an intention of moving a cursor in the upward direction, it is moved actually in an up-right direction, resulting in a problem that considerable skill is needed to be able to perform subtle operations accurately.

[0007]

The present invention has been made in view of such circumstances, and intends to make entries of various commands more comfortable, accurate, and efficient in a portable information terminal such as a mobile phone.

[0008]

[MEANS FOR SOLVING THE PROBLEMS]

A portable information terminal of the present invention is characterized by including: a rotation detection means for detecting rotation of a rotation body

having a substantially disc-like shape; a press detection means for detecting a press of the rotation body in a direction substantially perpendicular to an upper surface of the rotation body with a rotation axis of the rotation body as a fulcrum; and a display control means for controlling display of an image, and in that the display control means rotates and displays the image in accordance with the rotation of the rotation body detected by the rotation detection means and displays the image after switching said image in accordance with a result of detection by the press detection means.

[0009]

The display control means can control displaying of a plane image as the image and display the plane image after rotating in a counterclockwise direction or a clockwise direction about a center of the image in accordance with the rotation of the rotation body detected by the rotation detection means.

[0010]

The display control means can controls displaying of a three-dimensional image in a virtual space as the image and display the three-dimensional image after rotating in a horizontal plane in the virtual space setting a current position in the virtual space as reference in accordance with the rotation of the rotation body detected by the rotation detection means.

[0011]

The display control means can scale up/down and display the three-dimensional image corresponding to a position where the press detection means detects the press.

[0012]

A program according to the present invention is executed by a computer which controls a portable information terminal having: a rotation detection means for detecting rotation of a rotation body having a substantially disc-like shape; a press detection means for detecting a press of the rotation body in a direction substantially perpendicular to an upper surface of the rotation body with a rotation axis of the rotation body as a fulcrum; and a display means for displaying an image, the program is characterized by comprising the step of: controlling

displaying of the image in the display means; the step of controlling rotates and displays the image in accordance with the rotation of the rotation body detected by the rotation detection means and displays the image after switching the image in accordance with a result of detection by the press detection means.

[0013]

In the portable information terminal and the program according to the present invention, rotation of a rotation body having a substantially disc-like shape is detected, and pressing in a direction substantially perpendicular to an upper surface of the rotation body with a rotation axis of the rotation body as a fulcrum is detected to control display of an image. In addition, the image is rotated and displayed in accordance with the rotation of the rotation body and the image is displayed after a range of the image is switched in accordance with a result of detection.

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0014]

Fig. 1 is a diagram showing a configuration example of an external appearance of a mobile phone 1 to which the present invention is applied.

[0015]

A rotation input section 14 generally in a disc-like shape is provided substantially at the center of the mobile phone 1. The rotation input section 14 is formed rotatably in a clockwise direction or a counterclockwise direction about a rotation axis perpendicular to the sheet substantially at the center as shown by outline arrows. A user can operate the rotation input section 14, a call button 15 and a power button provided on the left and right of the rotation input section 14, and a numerical keypad 17 provided thereunder to input various commands.

[0016]

In the mobile phone 1 shown in Fig. 1, the user can rotate the rotation input section 14 or press a predetermined position of a top surface (a plane) of the rotation input section 14 toward an inner direction of the mobile phone 1, for example to play a predetermined game or use a map while seeing a display section 13 formed, for example, of an LCD (Liquid Crystal Display).

[0017]

A speaker 12 and a microphone 18 are provided near a top end and near a bottom end of a front face of the mobile phone 1, respectively, which the user utilizes at the time of making a call. In addition, an antenna 11 is provided at a top end of the mobile phone 1 in the state in which it protrudes from a housing.

[0018]

It should be noted that the mobile phone 1 is formed such that a first housing provided with the display section 13 and a second housing provided with the rotation input section 14 and the numerical keypad 17 are foldable through a hinge, in addition to a so-called straight type shown in Fig. 1.

[0019]

Figs. 2 to 5 show an example of the structure of the rotation input section 14.

[0020]

As shown in Fig. 2, the rotation input section 14 is basically formed of a base 31, a holder 32, a scale 33, a dial body 34, an operation dial 35, and a central button member 36.

[0021]

The base 31 is made, for example, from an insulating resin and formed as a substantially rectangular plate shape. A central button 41 is provided at the center of an upper surface of the base 31, and thereabout, peripheral buttons 42A to 42D are provided at regular intervals. The base 31 is disposed such that a line connecting the peripheral button 42A with the peripheral button 42C is substantially in parallel with a central line in the up-and-down direction of the mobile phone 1 in Fig. 1. Thus, the peripheral button 42A is positioned on the upper side of the mobile phone 1 shown in Fig. 1, while the peripheral button 42B is positioned on the left side. In addition, the peripheral button 42C is positioned on the lower side of the mobile phone 1 shown in Fig. 1, while the peripheral button 42D is positioned on the right side (hereinafter the peripheral button 42A is referred to as an upper button 42A, the peripheral button 42B as a left button 42B, the peripheral button 42C as a lower button 42C, and the

peripheral button 42D as a right button 42D, respectively, as appropriate).

[0022]

An upper movement limiting member 43 is provided with a nail extending toward the center of the base 31. The nail limits an upward movement of the holder 32. Rotation limiting members 44A and 44B are provided on both sides of the upper movement limiting member 43 slightly spaced therefrom. The rotation limiting members 44A and 44B limit rotation of the holder 32. These upper movement limiting member 43, and the rotation limiting members 44A and 44B constitute a holder limiting section 51A. Similarly, holder limiting sections 51B, 51C, and 51D are disposed in other three corners out of the four corners of the base 31.

[0023]

The holder 32 is formed in the shape of an insulating disk having a hole at the center. A dial holding cylinder 61 for rotatably holding the dial body 34 and the like is formed in the central portion of the upper surface to protrude from the periphery of the hole toward the upper surface (upward in Fig. 2). Thus, a central axis of the hole of the dial holding cylinder 61 serves as an rotational axis of the dial body 34 and the like.

[0024]

In addition, brushes 62A, 62B, and 62C which are elastic materials having conductivity are provided on the upper surface of the holder 32. The rotation amount and the rotation direction of the rotation input section 14 (the operation dial 35) are detected by detecting a change in the electrical connection state between the brushes 62A, 62B, and 62C with the scale 33 disposed on the holder 32.

[0025]

Specifically, positions in a diameter direction where the brushes 62A and 62B are disposed correspond to positions where they come into contact with slits 72 of the scale 33 when the scale 33 is disposed on the holder 32. When the rotation input section 14 is rotationally operated and the scale 33 is rotated in association therewith, contact (at the position between two of the slits 72) and

non-contact (at the position of one of the slits 72) are repeated between the brushes 62A and 62B and the scale 33.

[0026]

On the other hand, the brush (earth brush) 62C is provided at the position where it is always in contact with the scale 33 when the scale 33 is disposed on the holder 32. In addition, the brush (earth brush) 62C repeats conduction and non-conduction to the brush 62A or 62B through the scale 33 when the scale 33 is rotated.

[0027]

Thus, in the rotation input section 14, the rotation amount of the rotation input section 14 can be calculated on the basis of the number of pulses generated in accordance with a change in the conductive state between the brush 62A or 62B and the brush 62C (repeated contact and non-contact between the brush 62A or 62B and the scale 33).

[0028]

In addition, the rotation direction of the rotation input section 14 can be detected by providing the brush 62A and the brush 62B with a slight distance between them in the circumferential direction. Specifically, when the rotation input section 14 is rotated in the counterclockwise direction in the state in Fig. 1, a rising edge (or a falling edge) of the pulse generated by the brush 62A coming into contact with the scale 33 is detected at an earlier point in time than the rising edge (or the falling edge) of the pulse generated by the brush 62B coming into contact with the scale 33 corresponding to the distance between them.

[0029]

In contrast, when the rotation input section 14 is rotated in the clockwise direction, the rising edge (or the falling edge) of the pulse generated by the brush 62B coming into contact with the scale 33 is detected at an earlier point in time than the rising edge (or the falling edge) of the pulse generated by the brush 62A coming in contact with the scale 33.

[0030]

Thus, the rotation direction of the rotation input section 14 is detected on

the basis of the timing difference between the rising edges (or the falling edges) of the pulses thus found.

[0031]

Limited members 63A to 63D are formed at periphery portions of the holder 32 corresponding to the holder limiting sections 51A to 51D. When the holder 32 is disposed on the base 31, displacements (rotation and separation) of the limited members 63A to 63D are limited by the holder limiting sections 51A to 51D, respectively.

[0032]

Button pressing protrusions 101A to 101D are provided at positions corresponding to the peripheral buttons 42A to 42D on the back of the holder 32 as shown in Fig. 3. Thus, when the upper side of the rotation input section 14 is pressed in a direction perpendicular to the sheet in the mobile phone 1 shown in Fig. 1, the button pressing protrusion 101A presses the upper button 42A (the peripheral button 42A), and when the left side of the rotation input section 14 is pressed, the button pressing protrusion 101B presses the left button 42B (the peripheral button 42B). Similarly, when the lower side of the rotation input section 14 is pressed, the button pressing protrusion 101C presses the lower button 42C (the peripheral button 42C), and when the right side of the rotation input section 14 is pressed, the button pressing protrusion 101D presses the right button 42D (the peripheral button 42D).

[0033]

Dial body holding members 64A to 64D are formed at periphery portions of the holder 32 such that they are spaced by a predetermined distance and protrude toward the upper surface (upward in Fig. 2). The dial body holding members 64A to 64D are provided at the top ends thereof with nails extending toward the center of the holder 32 such that the nails limit separation of the dial body 34.

[0034]

In addition, a click feel protrusion 65 is provided on the upper surface of the holder 32. When the rotation input section 14 is rotated, a click feel is

produced for the user by the click feel protrusion 65 and a click feel uneven portion 83 of the dial body 34.

[0035]

A hole 71 through which the dial holding cylinder 61 is inserted is formed at a central portion of the scale 33, and thereabout, a number of the slits 72 are formed radially with a predetermined angular pitch near the edge of the scale 33 as described above. The scale 33 is fixed to a back face of the dial body 34 and disposed on the holder 32 as shown in Fig. 4.

[0036]

A hole 81 is formed through which the dial holding cylinder 61 is inserted at the center of the dial body 34. In addition, a transmission protrusion 82 is formed on the upper surface of the dial body 34. The transmission protrusion 82 is fitted into a transmission depression 92 formed in the back of the operation dial 35 to transmit the rotation force of the operation dial 35 to the dial body 34.

[0037]

In addition, the wave-shaped click feel uneven potion 83 as shown in Fig. 4 is formed at a periphery portion on a back face of the dial body 34 along the overall length, and the click feel protrusion 65 is fitted with play into a depression thereof as described above.

[0038]

A hole 91 through which the central button member 36 is inserted is formed at the center of the operation dial 35. In addition, a transmission depression 92 into which the transmission protrusion 82 of the dial body 34 is fitted is formed in a back face of the operation dial 35. A number of grooves 93 extending radially are formed to cause appropriate friction at the time of rotation operation to improve operability.

[0039]

The respective members described above constitute the rotation input section 14 as shown in Fig. 5 which is incorporated in the mobile phone 1 in a state in which the upper surface of the operation dial 35 is exposed.

[0040]

In the rotation input section 14 shown in Fig. 5, the user can press an upper-right portion (the upper side in Fig. 1) of the operation dial 35, for example to move a cursor displayed on the display section 13 upward, and also, press an upper-left portion (the left side in Fig. 1) of the operation dial 35 to move the cursor displayed on the display section 13 to the left.

[0041]

Specifically, the peripheral button 42A is placed in the portion of the base 31 corresponding to the upper-right portion of the rotation input section 14 shown in Fig. 5, and the peripheral button 42B is placed in the portion of the base 31 corresponding to the upper-left portion. When those buttons are pressed, the cursor is moved as described above in association with the pressing.

[0042]

Fig. 6 is a block diagram showing an inner configuration example of the mobile phone 1 to which the present invention is applied.

[0043]

A control section 111 deploys a control program stored in a ROM (Read Only Memory) 117A of a memory 117 in a RAM (Random Access Memory) 117B, and controls the overall operations of the mobile phone 1 in accordance with the deployed program.

[0044]

For example, the control section 111 starts a predetermined program based on an instruction from a user and displays a game image or a map on the display section 13. Then, when a rotation detection section 121 of an input detection section 115 detects an entry to the rotation input section 14 (when the rotation input section 14 is rotated), the control section 111 controls a DSP (Digital Signal Processor) to calculate the rotation amount, the rotation direction or the like of the rotation input section 14 and controls the display of the image displayed on the display section 13. The processing of the control section 111 for controlling the display on the display section 13 in response to an entry to the rotation input section 14 is later described in detail.

[0045]

An RF (Radio Frequency) section 112 transmits/receives radio waves to and from a base station through the antenna 11. For example, in a voice call mode, the RF section 112 amplitudes an RF signal received by the antenna 11 and performs predetermined processing such as frequency conversion processing and analog/digital conversion processing, and outputs resulting voice data to a DSP 113. In addition, when voice data is supplied from the DSP 113, the RF section 112 performs predetermined processing such as digital/analog conversion processing and frequency conversion processing, and transmits a resulting voice signal from the antenna 11.

[0046]

The DSP 113 performs, for example despread spectrum processing on voice data supplied from the RF section 112, and outputs the resulting data to a voice codec 114. In addition, the DSP 113 performs spread spectrum processing on voice data supplied from the voice codec 114 and outputs the resulting data to the RF section 112. Also, the DSP 113 performs processing such as the calculation of a rotation amount for displaying an image, the calculation of a rotation direction, and the calculation of a display range in accordance with control by the control section 111.

[0047]

The voice codec 114 converts voice of a user collected by the microphone 18 into voice data and outputs it to the DSP 113. In addition, the voice codec 114 converts voice data supplied from the DSP 113 to an analog voice signal and outputs the corresponding voice signal from the speaker 12.

[0048]

The rotation detection section 121 of the input detection section 115 is connected to the brushes 62A, 62B, and 62C shown in Fig. 2. The rotation detection section 121 monitors the state of contact or non-contact between the brushes 62A and 62B and the scale 33 and outputs pulses in correspondence with a change in the contact state to the control section 111 as described above.

[0049]

A press detection section 122 of the input detection section 115 is connected to the central button 41 and to the peripheral switches 42A to 42D shown in Fig. 2. When these buttons are pressed (when the upper surface of the rotation input section 14 is pressed in the inner direction), the press detection section 122 detects the pressing and outputs an associated signal to the control section 111.

[0050]

The control section 111 is connected to a drive 210 as required. A magnetic disk 211, an optical disc 212, a magneto-optical disc 213, or a semiconductor memory 214 and the like are loaded in the drive 210 as appropriate, and a computer program read therefrom is installed on the control section 111 as required.

[0051]

The input detection section 116 detects an entry from the call button 15, the power button 16, and another button such as the numeric keypad 17 provided for the mobile phone 1, and outputs the associated signal to the control section 111.

[0052]

Next, description is made for the operations of the mobile phone 1 having the configuration described above.

[0053]

First, description is made for processing of the control section 111 for controlling display of an image (a plane image) in response to an entry to the rotation input section 14 in a game in which a main character (hereinafter called avatar as appropriate) is moved in a two-dimensional plane with reference to flow charts of Figs. 7 and 8.

[0054]

Figs. 9 are diagrams showing the operation on the rotation input section 14 and a corresponding example of movement of an avatar 131 displayed on the display section. In Fig. 9B, the upper side corresponds to the front side of the avatar 131.

[0055]

For example, as shown in Fig. 9A, when the upper side of the rotation input section 14 is pressed and the press detection section 122 detects the pressing of the upper button 42A, the control section 111 causes the avatar 131 displayed on the display section 13 to proceed in the plane (a background image is scrolled downward (switched)) as shown in Fig. 9B. Similarly, as shown in Fig. 9A, when the rotation input section 14 is pressed and the press of the left button 42B, the lower button 42C, or the right button 42D is detected, the control section 111 causes the avatar 131 to move in the left direction, the lower direction, or the right direction in the plane as shown in Fig. 9B (the background is scrolled in the right direction, the upper direction, or the left direction).

[0056]

In addition, when the rotation input section 14 is rotationally operated in the clockwise direction or the counterclockwise direction as shown in Fig. 9A, and the rotation detection section 121 detects it, the control section 111 causes the front of the avatar 131 to be rotated in the clockwise direction or the counterclockwise direction in accordance with the rotation amount as shown in Fig. 9B. For example, when the front of the avatar 131 is set to face in the upper direction of the screen, the background image is rotated in the counterclockwise direction or the clockwise direction by a predetermined angle about the position of the avatar 131 (the center of the display section 13).

[0057]

When the rotation input section 14 is operated, at step S1 in Fig. 7, the control section 111 determines whether or not the rotation detection section 121 detects rotation. Specifically, the control section 111 determines whether or not rotation of the orientation of the avatar 131 is instructed, and when it determines that rotation is not instructed, it proceeds to step S2.

[0058]

At step S2, the control section 111 determines whether or not the press detection section 122 detects press of the upper button 42A. In other words, the control section determines whether or not proceeding of the avatar 131 is

instructed, and when it determines that proceeding is instructed, it proceeds to step S3 where it causes the avatar 131 to proceed in the plane (the background displayed on the display section 13 is scrolled downward).

[0059]

A screen shown in a display section 13A in Fig. 10 is a view showing a display example of the display section 13. A street 141 is displayed in the up-and-down direction as a background image. A street 142 and a street 143 are displayed horizontally in an upper-right portion and a lower-left portion of the display section 13A. In addition, the avatar 131 is displayed at a central position P1 of the display section 13A.

[0060]

Thus, in a state of the screen shown in the display section 13A of Fig. 10, when the upper button 42A is pressed, the display becomes that shown as a display section 13B indicated by an outline arrow A1. Specifically, the image is switched such that the avatar 131 is moved to a position P2 above the position P1 by a predetermined distance and the position P2 corresponds to the center of the display section 13 (the background is scrolled downward from the state of the display of the display section 13A).

[0061]

Returning to the description of Fig. 7, after the background is switched at step S3, the processing is ended. When the rotation input section 14 is again operated, similar processing is performed.

[0062]

On the other hand, when the control section 111 determines that the press detection section 122 detects no press of the upper button 42A at step S2, it proceeds to step S4 where it determines whether or not press of the lower button 42C, that is, whether or not receding of the avatar 131 is instructed is detected.

[0063]

When the control section 111 determines that receding of the avatar 131 is instructed at step S4, it proceeds to step S5 where it causes the avatar 131 to recede in the plane (the background displayed on the display section 13 is

scrolled upward).

[0064]

Thus, for example, when the lower button 42C is pressed in the state of the screen shown in the display section 13B of Fig. 10, the display becomes that shown as the display section 13A. Specifically, the image is scrolled upward such that the position P1 corresponds to the center of the image (the position of the avatar 131).

[0065]

When the control section 111 determines that the press detection section 122 detects no press of the lower button 42C at step S4, it proceeds to step S6 where it determines whether or not press of the left button 42B that is, whether or not movement of the avatar 131 to the left is instructed is detected.

[0066]

When the control section 111 determines that movement of the avatar 131 to the left is instructed at step S6, it proceeds to step S7 where it causes the avatar 131 to move to the left (the background displayed in the display section 13 is scrolled to the right).

[0067]

For example, when the left button 42B is pressed in a state of the screen shown as the display section 13A in Fig. 10, the display becomes that shown in as a display section 13C indicated by an outline arrow A2 by processing at step S7.

[0068]

Specifically, the background is scrolled to the right such that the avatar 131 is moved to a position P3 on the left of the position P1 and the position P3 corresponds to the center of the screen. Thus, the street 142 is displayed with a smaller lateral length and the street 143 is displayed with a larger lateral length corresponding to the movement of the avatar 131 as compared with the screen shown as the display section 13A.

[0069]

On the other hand, when the control section 111 determines that the press detection section 122 detects no press of the left button 42B at step S6, it

proceeds to step S8 where it determines whether or not press of the right button 42D, that is, whether or not movement of the avatar 131 to the right is instructed is detected.

[0070]

When the control section 111 determines that movement of the avatar 131 to the right is instructed at step S8, it proceeds to step S9 where it causes the avatar 131 to move to the right (the background displayed in the display section 13 is scrolled to the left).

[0071]

For example, when the right button 42D is pressed in a state in which the screen of the display section 13C in Fig. 10 is displayed, the background is scrolled to the left such that the avatar 131 stands at the central position P1 of the screen, and the display becomes that shown as the display section 13A.

[0072]

On the other hand, when the control section 111 determines that press of the right button 42D is not detected at step S8, it recognizes that the central button 41 is pressed, and it proceeds to processing at step S10. At step S10, the control section 111 performs processing (an action) previously set to be performed when the central button 41 is pressed.

[0073]

For example, when talking to a partner in front of the avatar 131 is set as the action when the central button 41 is pressed, the control section 111 causes the avatar to perform the action of talking to the partner in front at step S10. In this manner, various actions can be set in association with the central button 41, for example, causing the avatar 131 to jump, or attacking a partner in front.

[0074]

On the other hand, when the control section 111 determines that the rotation detection section 121 detects rotation at step S1, it determines whether or not rotation in the clockwise direction is detected at step S11 in Fig. 8. In other words, the control section 111 determines whether or not rotation of the front of the avatar 131 in the clockwise direction relative to the current front is directed.

[0075]

As described above, the control section 111 detects the rotation direction on the basis of a timing difference between the rising edges (or the falling edges) of the pulse generated by the brush 62A coming into contact with the scale 33 and the pulse generated by the brush 62B coming into contact with the scale 33.

[0076]

When the control section 111 determines that rotation in the clockwise direction is detected at step S11, it proceeds to processing at step S12. The control section 111 calculates the rotation amount on the basis of the number of the pulses detected by the rotation detection section 121, and causes the avatar 131 to be rotated in the clockwise direction in accordance with the calculated rotation amount (the background is rotated in the counterclockwise direction relative to the center of the display section 13).

[0077]

For example, when the rotation input section 14 is rotated 90 degrees in the clockwise direction in the state of the screen shown as the display section 13A in Fig. 10, the screen displayed in the display section 13 becomes that shown as a display section 13D indicated by an outline arrow A3.

[0078]

Specifically, in the display section 13D, the background is rotated 90 degrees in the counterclockwise direction about the position P1 and is rotated such that the front of the avatar 131 corresponds to the right side of the display section 13A. As a result, the street 141 is displayed as a lateral street in the display section 13D, and the street 142 and the street 143 are displayed as vertical streets.

[0079]

In this example, the angle of the rotation of the rotation input section 14 and the angle of the rotation of the avatar 131 are set at the same ratio (1:1), but the rotation ratio may be set according to preference, for example, by setting a larger rotation angle of the avatar 131 than an angle of rotation of the rotation input section 14.

[0080]

On the other hand, when the control section 111 determines that rotation in the clockwise direction is not detected at step S11, it recognizes that rotation in the counterclockwise direction is detected, and it proceeds to processing at step S13. The control section 111 calculates the rotation amount on the basis of the number of the pulses detected by the rotation detection section 121 and causes the avatar 131 to be rotated in the counterclockwise direction in accordance with the calculated rotation amount (the background is rotated in the clockwise direction about the center of the screen).

[0081]

For example, in a state of the screen shown as the display section 13D in Fig. 10, when the rotation input section 14 is rotated 90 degrees in the counterclockwise direction, the displayed screen becomes that shown as the display section 13A.

[0082]

Every time an entry to the rotation input section 14 is detected, the aforementioned processing is performed. Thus, the user can input various commands more accurately and efficiently by rotating or pressing only the rotation input section 14 which is the single operation section without operating the plurality of buttons provided with spacing between them. In addition, since the rotation input section 14 is rotated and the screen is rotated in association therewith, operations can be performed with a sense of synchronization with the display of the screen.

[0083]

While the description above has been made for the case where the avatar 131 displayed within the plane is moved, the aforementioned processing can be applied to a case where display of a map displayed in the display section 13 is switched.

[0084]

For example, in a state in which a map is displayed as shown in a display section 13A in Fig. 11 and a position P11 corresponds to the center of the screen,

when the upper button 42A of the rotation input section 14 is pressed, the map shown in the display section 13A is scrolled downward such that a position P12 above the position P11 corresponds to the center of the screen. The display becomes that shown as a display section 13B indicated by an outline arrow A11.

[0085]

Similarly, in the state of display shown in the display section 13A, when the rotation input section 14 is rotated by a predetermined angle in the counterclockwise direction, the display becomes that shown as a display section 13C indicated by an outline arrow A12.

[0086]

Specifically, the map rotated in the clockwise direction about the position P11 of the display section 13A is displayed such that the left side of the display section 13A corresponds to the upper side of the screen. In the display section 13C, the position P12, which is in an upper portion of the display of the display section 13A, is moved in the right direction of the screen.

[0087]

In the state of display shown in the display section 13A, when the right button 42D of the rotation input section 14 is pressed, a position P13, which is on the right side in the display of the display section 13A, is scrolled to be displayed corresponding to the center, and the display becomes that shown as a display section 13D indicated by an outline arrow A13.

[0088]

When the display of the map is switched as described above, for example, the scale of the map can be sequentially switched such that scale-up display or scale-down display of the map is performed every time the central button 41 is operated.

[0089]

While the aforementioned description has been made for the case where the display of the plane image is switched as shown in Figs. 10 and 11, description is made next for switching of display of a three-dimensional image such as a landscape image in a virtual space and a map image displayed as a bird

view with reference to flow charts of Figs. 12 and 13.

[0090]

First, description is made for processing of switching display of a background image in response to movement of an avatar 151 in Fig. 14 in a virtual space displayed in the display section 13.

[0091]

Substantially at the center of a display portion 13A in Fig. 14, the back of the avatar 151 is shown. The avatar 151 can be moved by operating the rotation input section 14. In the display portion 13A, an object 161 is displayed at the center of the screen (in front of the avatar 151), and an object 162 is displayed on the left thereof. An object 164 is displayed on the right of the object 161 relative to the front of the avatar 151. In the display portion 13A, the avatar 151 is supposed to stand currently at a position P21. A position P22 is a position spaced to the left from the position P21 by a predetermined distance.

[0092]

For example, in a state of the screen displayed in the display portion 13A in Fig. 14, the control section 111 determines whether or not the rotation detection portion 121 detects rotation at step S21 in Fig. 12, that is, whether or not turning of the orientation of the avatar 151 is instructed.

[0093]

At step S21, when the control section 111 determines that turning of the orientation of the avatar 151 is not instructed, it proceeds to step S22 where it determines whether or not the press detection section 122 detects press of the upper button 42A. In other words, the control section 111 determines whether or not proceeding of the avatar 151 is instructed.

[0094]

When the control section 111 determines that proceeding of the avatar 151 is directed at step S22, it proceeds to step S23 where it causes the avatar 151 to proceed in the virtual space and displays with scaled-up the landscape image (zoom-display) displayed on the display section 13.

[0095]

For example, in the state of the screen shown in the display section 13A in Fig. 14, when the upper button 42A is pressed, the avatar 151 is caused to proceed a predetermined distance in the virtual space, and the display becomes that shown as a display section 13B indicated by an outline arrow A21. Specifically, in the display section 13B in Fig. 14, the objects 161 and 162 are displayed with scale-up as compared with the display in the display section 13A. Since the object 164 is moved to the outside of a visual field, it is not displayed.

[0096]

On the other hand, at step S22, when the control section 111 determines that the press detection portion 122 detects no press of the upper button 42A, it proceeds to step S24 where it determines whether or not press of the lower button 42C is detected, that is, whether or not receding of the avatar 151 is instructed.

[0097]

When the control section 111 determines that receding of the avatar 151 is instructed at step S24, it proceeds to step S25 where it causes the avatar 151 to recede in the virtual space and performs scaled-down display of the background (wide-display) displayed in the display section 13.

[0098]

For example, in the state of the screen shown in the display section 13B in Fig. 14, when the lower button 42C is pressed, the respective objects are displayed with scale-down and the background of a wider area is displayed as shown in the display section 13A.

[0099]

When the control section 111 determines that the press detection section 122 detects no press of the low button 42C at step S24, it proceeds to step S26 where it detects whether or not press of the left button 42B is detected, that is, whether or not move of the avatar 151 to the left is instructed.

[0100]

When the control section 111 determines that move of the avatar 151 to the left is instructed at step S26, it proceeds to step S27 where it moves the avatar 151 to the left and scrolls the background displayed in the display section 13 to

the right.

[0101]

For example, in a state of the screen shown in the display section 13A in Fig. 14, when the left button 42B is pressed, the avatar 151 is moved to the position P22 and the background is scrolled to the right. The display becomes that shown as a display section 13C indicated by an outline arrow A22.

[0102]

In the display section 13C, the object 161 is displayed on the right and in front of the avatar 151, and an object 165, which is not displayed in the display section 13A, is newly displayed.

[0103]

On the other hand, when the control section 111 determines that the press detection section 122 detects no press of the left button 42B, it proceeds to step S28 where it determines whether or not press of the right button 42D is detected, that is, whether or not move of the avatar 151 to the right is instructed.

[0104]

When the control section 111 determines that move of the avatar 151 to the right is instructed at step 28, it proceeds to step S29 where it moves the avatar 151 to the right and scrolls the background displayed in the display section 13 to the left.

[0105]

For example, in the state in which the screen of the display section 13C in Fig. 14 is displayed, when the right button 42D is pressed, the background is scrolled to the left to switch the display range, and the avatar 151 is moved to the position P21, and the display becomes that shown in the display section 13A.

[0106]

When the control section 111 determines that press of the right button 42D is not detected at step S28, it recognizes that the central button 41 is pressed, and it proceeds to processing at step S30. In the processing at step S30, the control section 111 executes processing (an action) previously set to be executed when the central button 41 is pressed.

[0107]

For example, when talking to a partner in front of the avatar 151 is set as an action at the time when the central button 41 is pressed, the control section 111 causes the avatar 151 to perform the action of talking to the partner in front at step S30.

[0108]

On the other hand, when it is determined that the rotation detection section 121 detects rotation at step S21, the control section 111 determines whether or not rotation in the clockwise direction is detected at step S31 in Fig. 13. In other words, the control section 111 determines whether or not rotation of the front of the avatar 151 in the clockwise direction is instructed with the current position set as a reference in the horizontal plane of the virtual space.

[0109]

When the control section 111 determines that rotation in the clockwise direction is detected at step S31, it proceeds to step S32. At step S31, the control section 111 rotates the orientation of the avatar 151 in the clockwise direction and rotates the background in the counterclockwise direction relative to the current position of the avatar 151 in the horizontal plane of the virtual space in accordance with the calculated rotation amount.

[0110]

For example, when the rotation input section 14 is rotated in the clockwise direction by a predetermined angle in the state of the screen shown in the display section 13A in Fig. 14, the screen displayed in the display section 13 becomes that shown as a display section 13D indicated by an outline arrow A23.

[0111]

Specifically, the background is rotated in the counterclockwise direction in the horizontal plane about the position P21. For example, the object 164 displayed at the right end of the screen in the display section 13A is moved substantially to the front of the avatar 151 and displayed.

[0112]

On the other hand, when the control section 111 determines that no

rotation in the clockwise direction is detected at step S31, it recognizes that rotation in the counterclockwise direction is detected, and it proceeds to step S33. At step S33, the control section 111 rotates the orientation of the avatar 151 in the counterclockwise direction and rotates the background in the clockwise direction relative to the current position of the avatar 151 in accordance with the calculated rotation amount.

[0113]

For example, when the rotation input section 14 is rotated in the counterclockwise direction by a predetermined angle in the state of the screen shown in the display section 13D in Fig. 14, the displayed screen becomes that shown in the display section 13A.

[0114]

While the above description has been made for the back face of the avatar 151 constantly displayed at the center of the display section 13, it is possible that, as shown in Fig. 15, the avatar 151 is not displayed, a screen corresponding to the visual field of the user who utilizes the mobile phone 1 is displayed, and similarly, display of the background is switched with movement in the virtual space.

[0115]

For example, if display of a display section 13A in Fig. 15 is displayed, and when the lower button 42C of the rotation input section 14 is pressed, the screen displayed in the display section 13 is wide displayed one as shown as a display section 13B indicated by an outline arrow A31. In the display section 13B, objects 181 to 183 are displayed in a scaled-down manner as compared with the screen of the display section 13A.

[0116]

In addition, for example in a state in which the screen shown in the display section 13A in Fig. 15 is displayed, when the rotation input section 14 is rotated in the counterclockwise direction, the display becomes that shown as a display section 13C indicated by an outline arrow A32 in which the background is rotated in the clockwise direction in the horizontal plane about the current

position in the virtual space. Specifically, the left direction in the display section 13A becomes the front and the object 181 is displayed at the right end of the screen.

[0117]

In addition, for example, in the state of the screen of the display section 13A in Fig. 15 displayed, when the right button 42D of the rotation input section 14 is pressed, the display becomes that indicated by an outline arrow A33. The objects 181 and 182 are shifted to the left and displayed as compared with the display of the display section 13A.

[0118]

As described above, the user can switch the display of the three-dimensional image in the display section 13 by operating the rotation input section 14.

[0119]

Next, description is made for processing of switching display of a map (a three-dimensional image) as a bird view in the display section 13 in response to input from the rotation input section 14.

[0120]

For example, if a map shown in a display section 13A in Fig. 16 is displayed, and when the upper button 42A of the rotation input section 14 is pressed, the screen displayed in the display section 13 is zoom displayed as the screen of a display section 13B indicated by an outline arrow A41. In the display section 13B of Fig. 16, as compared with the display section 13A, the scale is changed to display an object 191 in the scaled-up manner.

[0121]

In addition, for example, if the screen shown in the display section 13A in Fig. 16 is displayed, and when the rotation input section 14 is rotated in the counterclockwise direction, the display becomes that indicated by an outline arrow A42 in which the background is rotated in the clockwise direction in the horizontal plane, and a wider area of a plane 191B of the object 191 is displayed (moved to the front of the user for display).

[0122]

In addition, if the screen shown in the display section 13A in Fig. 16 is displayed, and when the right button 42D of the rotation input section 14 is pressed, the display becomes that shown as a display section 13D indicated by an outline arrow A43. The object 191 is shifted to the left and displayed as compared with the display of the display section 13A.

[0123]

As described above, the image is rotated and displayed with the rotation of the rotation input section 14, so that it is possible to perform operation with a sense of synchronization with the display on the screen as compared with a case where the plurality of buttons are operated.

[0124]

In addition, since the single input section allows various operations, reduction in size can be achieved as compared with a mobile phone having a plurality of buttons individually provided.

[0125]

While the above description has been made for the rotation operation section 14 provided for the mobile phone 1, it is possible that an input section having the similar configuration is provided for a portable information terminal such as a PDA (Personal Digital Assistant) and a portable type personal computer, for example. Also, it can be applied to a portable information terminal as a various types of remote controllers for use in a television receiver, a video recorder, a car navigator and the like.

[0126]

While the aforementioned series of processing may be executed by hardware, they may be executed by software. When the series of processing is executed by software, programs forming the software are installed from a network or a recording medium to a computer incorporated in dedicated hardware or, for example, a general-purpose personal computer capable of executing various functions by installing various programs thereon.

[0127]

As shown in Fig. 6, the recording medium is formed of a package media realized by the magnetic disk 211 (including a floppy disk), the optical disc 212 (including a CD-ROM (Compact Disc-Read Only Memory) and a DVD (Digital Versatile Disc)), the magneto-optical disc 213 (including an MD® (Mini-Disc)), or the semiconductor memory 214, which are distributed for providing a user with the program and on which the programs are recorded, apart from the apparatus body. In addition thereto, it is formed of a ROM which is provided for a user in the state in which it is previously incorporated in the apparatus body and which has programs recorded thereon, or a hard disk included in a storage section, or the like.

[0128]

In the specification, the step for describing the program recorded on the recording medium includes not only processing executed on a time series basis in the described order but also processing executed in parallel or separately which is not necessarily executed on a time series basis.

[0129]

Effect of the Invention

According to the present invention, display can be controlled.

[0130]

Also, according to the present invention, various input operations can be performed more comfortably, accurately and efficiently.

[0131]

In addition, according to the present invention, operations with a sense of synchronization with display of a screen can be performed.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIG. 1] A front view showing a structure of an external appearance of a mobile phone to which the present invention is applied.

[FIG.2] An exploded view showing a structure of a rotation input section in Fig. 1;

[FIG. 3] A perspective view showing a structure of a back face of a holder in Fig. 2;

[FIG. 4] A perspective view showing a structure of a back face of a dial body in Fig. 2;

[FIG. 5] A perspective view showing the structure of the rotation input section in Fig. 1;

[FIG. 6] A block diagram showing an inner configuration example of the mobile phone in Fig. 1;

[FIG. 7] A flow chart for explaining display processing of the mobile phone in Fig. 1;

[FIG. 8] A flow chart for explaining the display processing of the mobile phone in Fig. 1, subsequent to Fig. 7;

[FIG. 9] Diagrams showing input to the rotation input section and an example of corresponding movement of an avatar;

[FIG. 10] A diagram showing an example of switching of screens displayed in a display section;

[FIG. 11] Adiagram showing another example of switching of screens displayed in the display section;

[FIG. 12] A flow chart for explaining another display processing of the mobile phone in Fig. 1;

[FIG. 13] A flow chart for explaining the other display processing of the mobile phone in Fig. 1, subsequent to Fig. 12;

[FIG. 14] A diagram showing an example of switching of screens displayed in the display section;

[FIG. 15] A diagram showing another example of switching of screens displayed in the display section;

[FIG. 16] A diagram showing a further example of switching of screens displayed in the display section;

[DESCRIPTION OF REFERENCE NUMERALS]

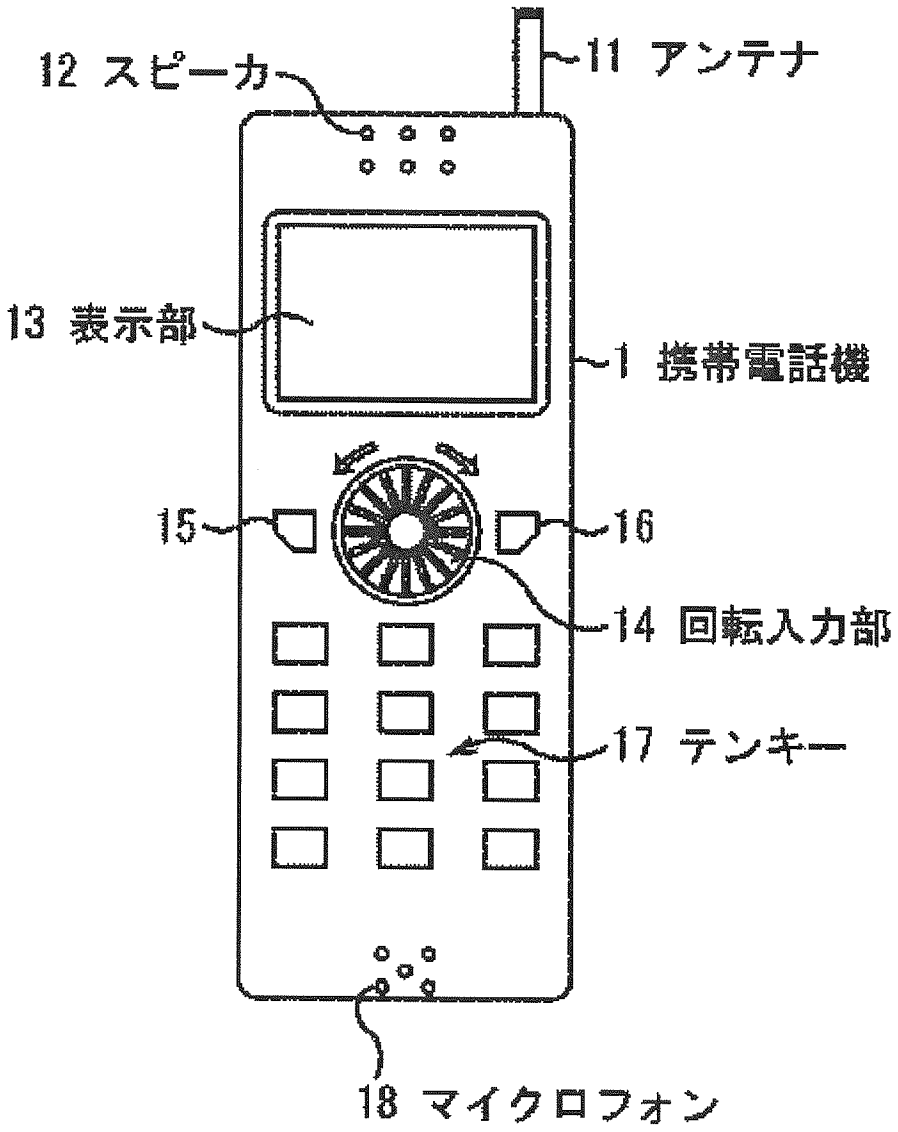
1	mobile phone
13	display section
14	rotation input section

111	control section
113	DSP
115	input detection section
121	rotation detection section
122	press detection section

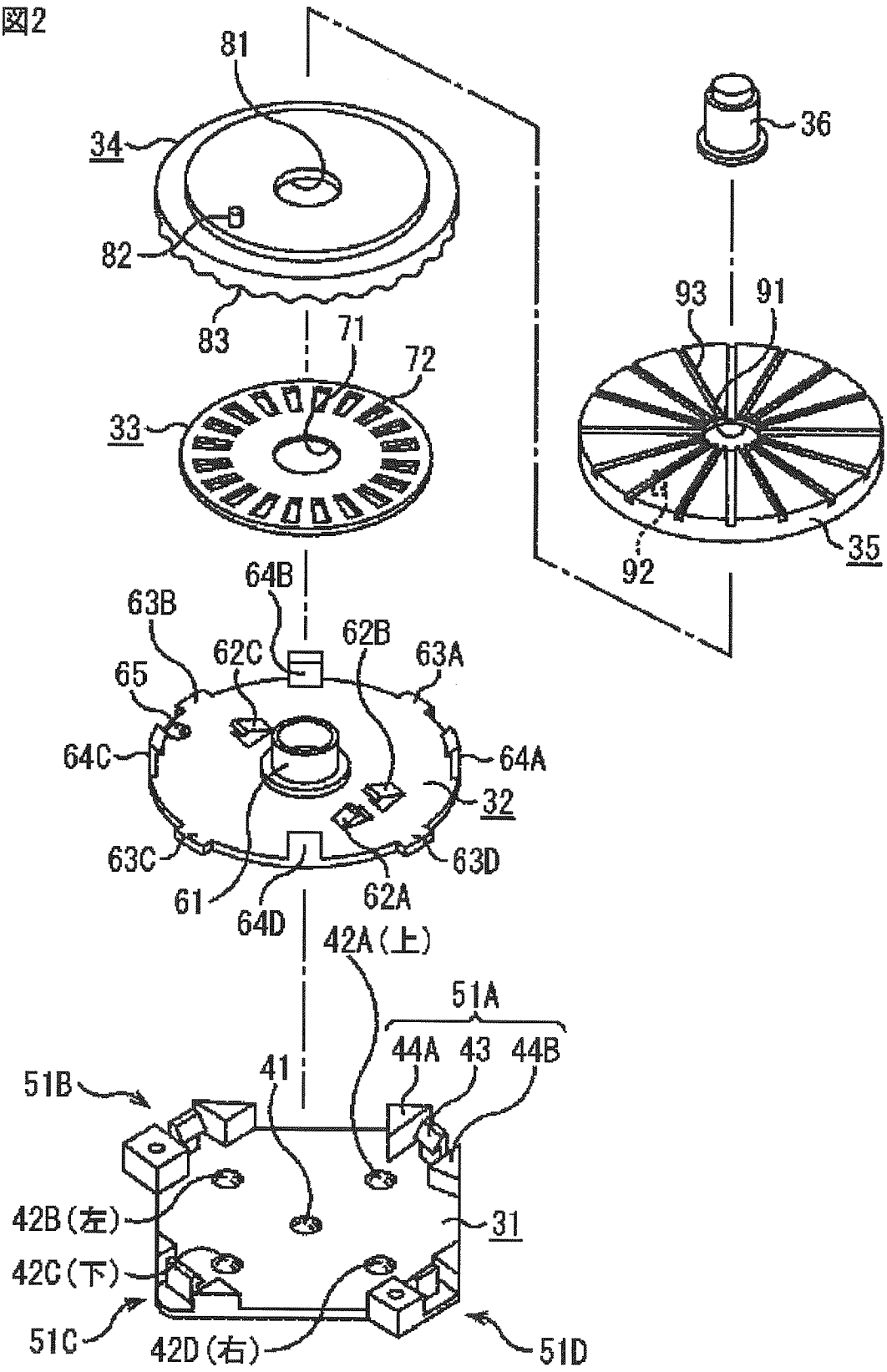
【書類名】図面

【図１】

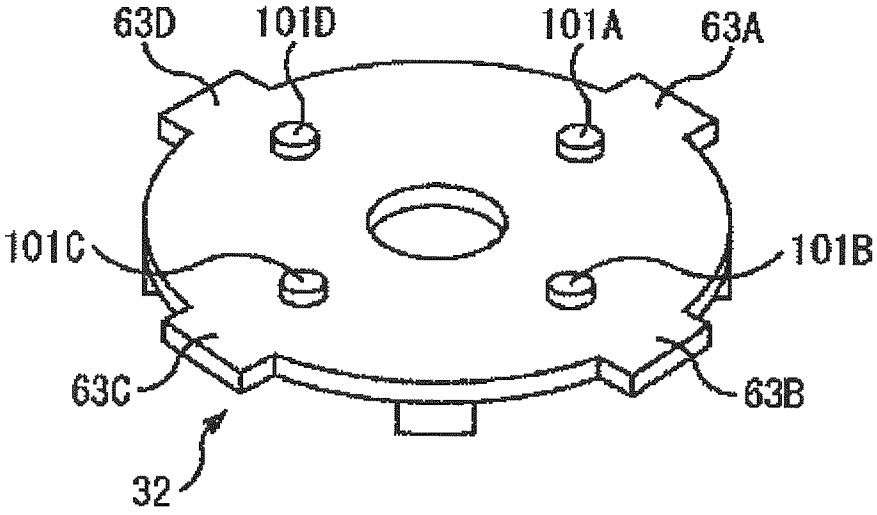
図1



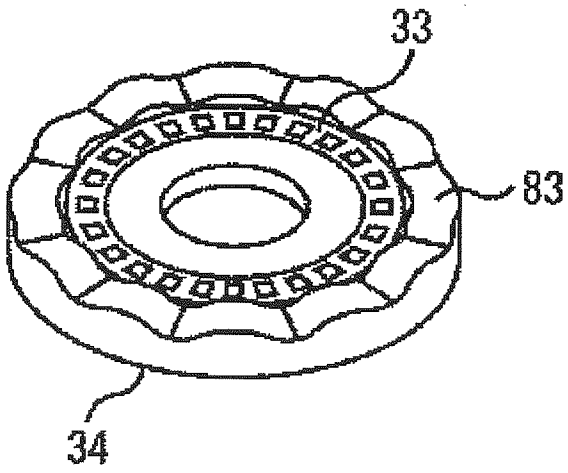
【図２】
図2


81
34
82
83
71
72
33
36
93
91
92
35
64B
63B
62C
62B
63A
65
64C
64A
32
63C
63D
61
64D
62A
42A(上)
51A
44A
43
44B
41
51B
42B(左)
31
42C(下)
51C
42D(右)
51D

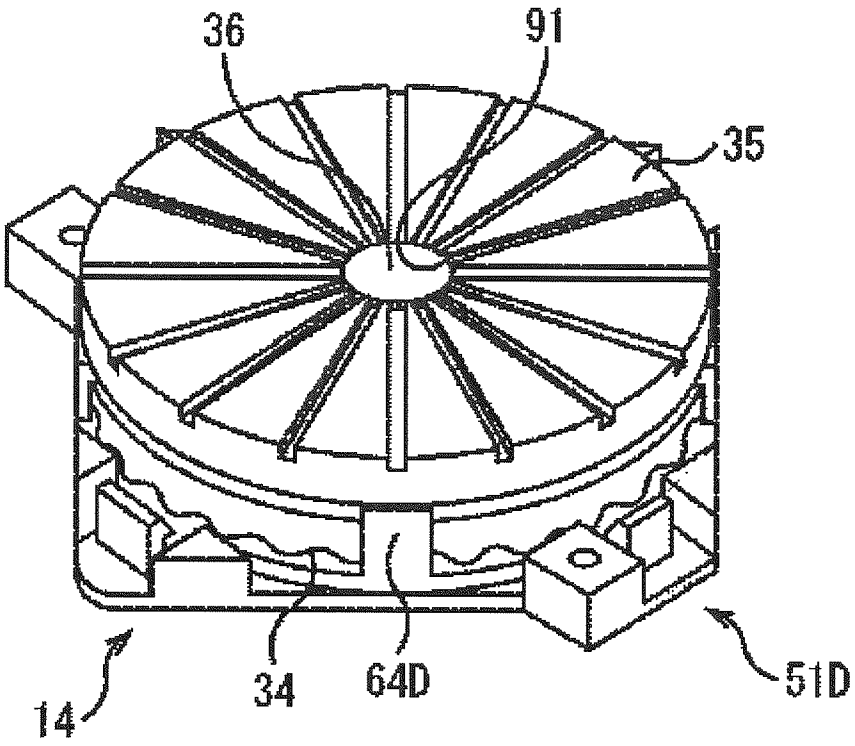
【図３】
図3



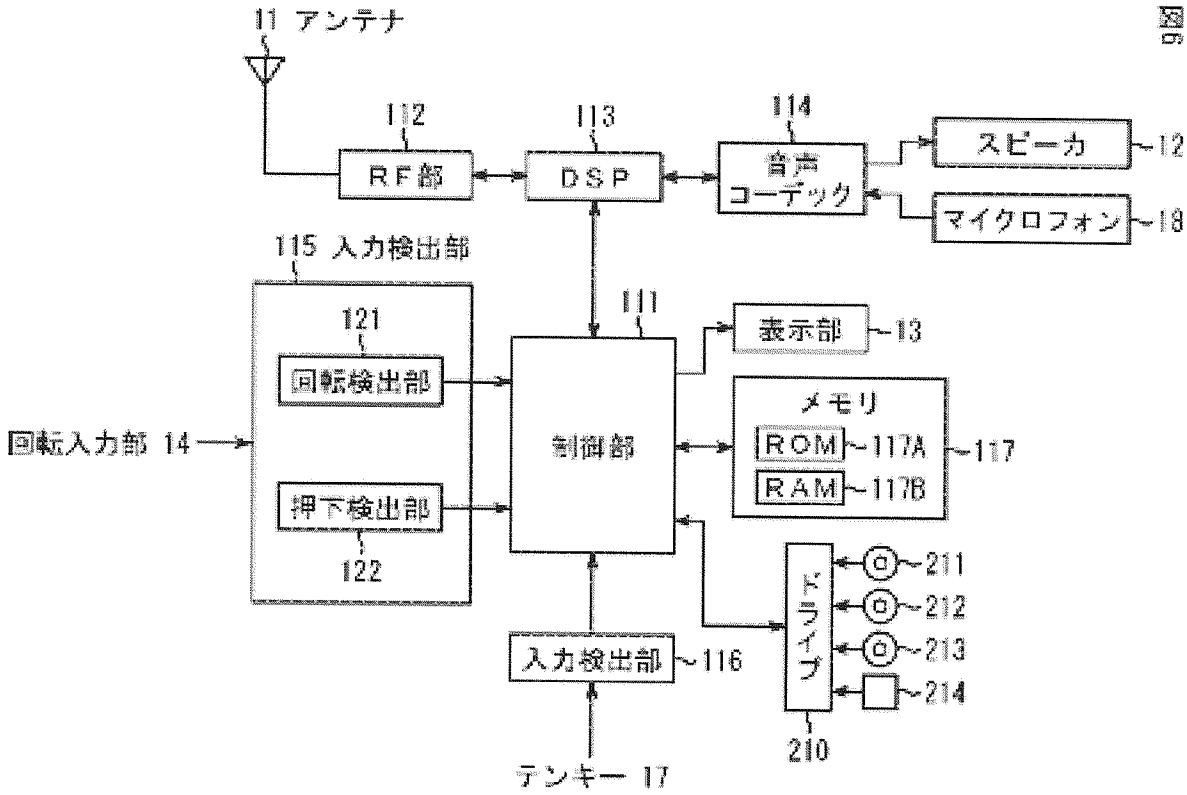
【図４】
図4



【図５】
図5



【図６】


11 アンテナ
112
RF部
113
DSP
114
音声
コーデック
スピーカ
12
マイクロフォン
18
115 入力検出部
121
回転検出部
押下検出部
122
回転入力部 14
111
制御部
表示部
13
メモリ
ROM
117A
RAM
117B
117
ドライブ
211
212
213
214
210
入力検出部
116
テンキー 17

【図７】

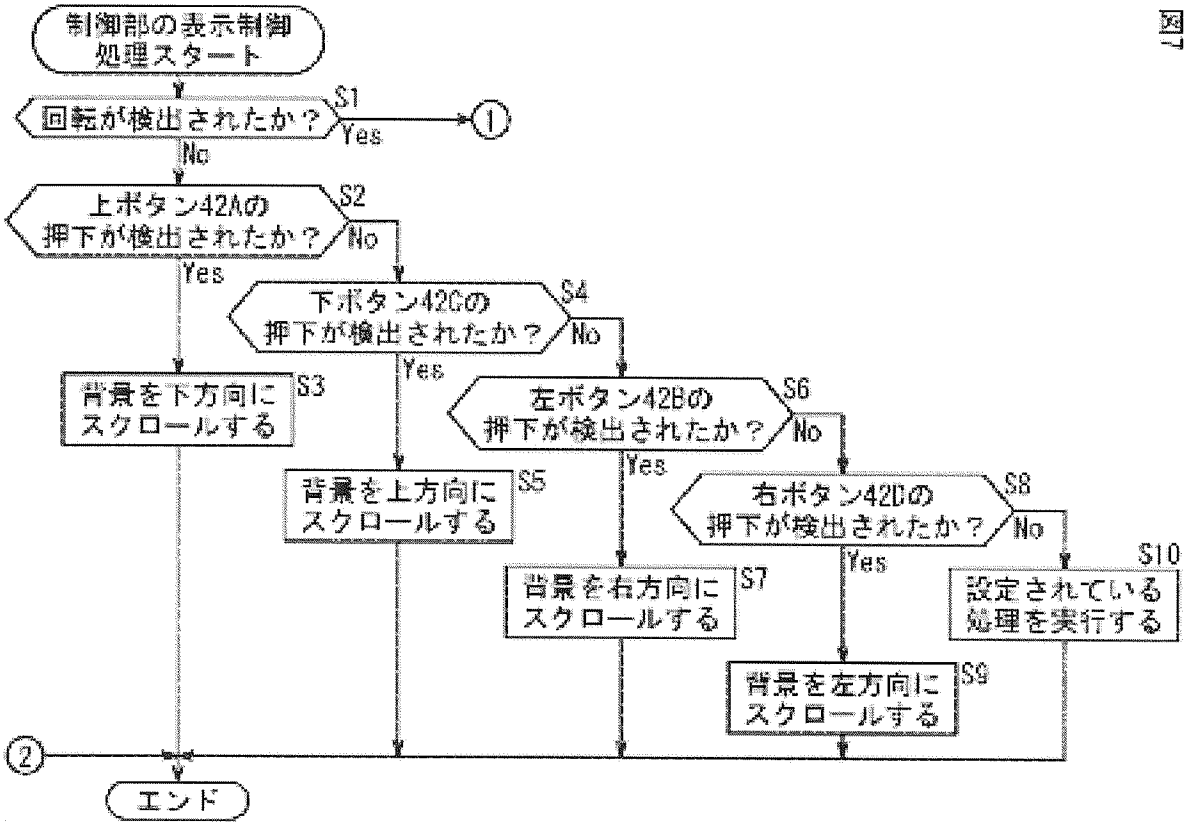
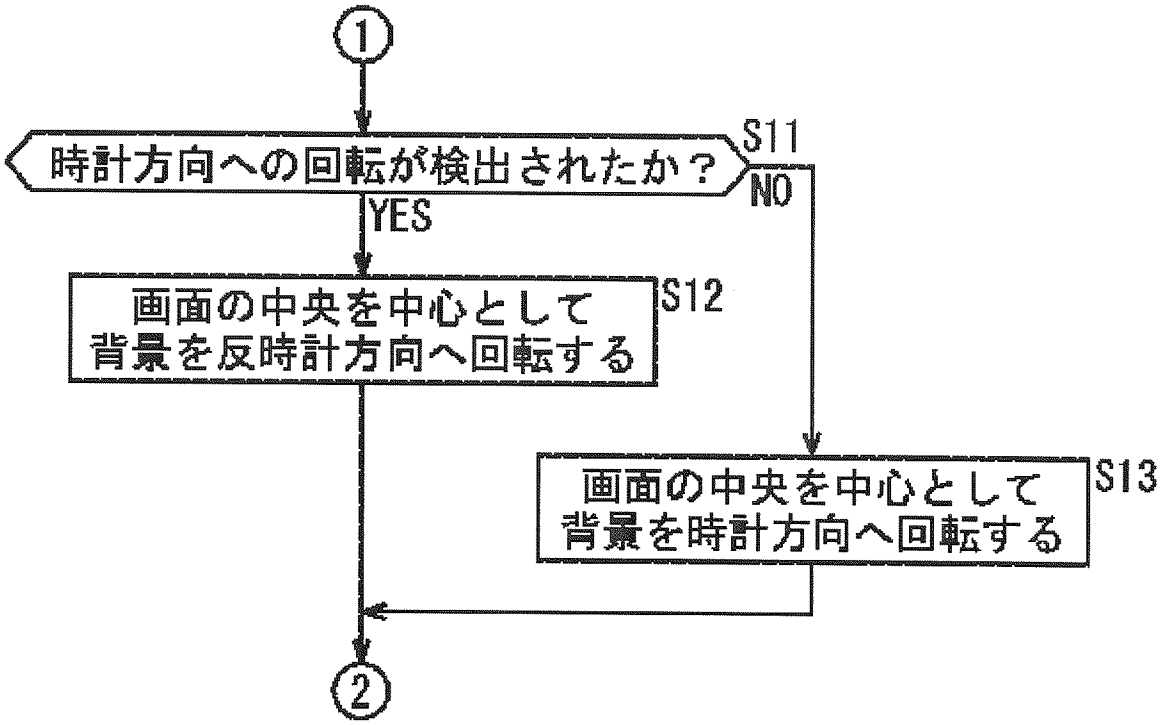

制御部の表示制御処理スタート
回転が検出されたか？
S1
Yes
①
No
上ボタン42Aの押下が検出されたか？
S2
No
Yes
下ボタン42Cの押下が検出されたか？
S4
No
Yes
背景を下方向にスクロールする
S3
左ボタン42Bの押下が検出されたか？
S6
No
Yes
背景を上方向にスクロールする
S5
右ボタン42Dの押下が検出されたか？
S8
No
Yes
S10
背景を右方向にスクロールする
S7
設定されている処理を実行する
背景を左方向にスクロールする
S9
②
エンド

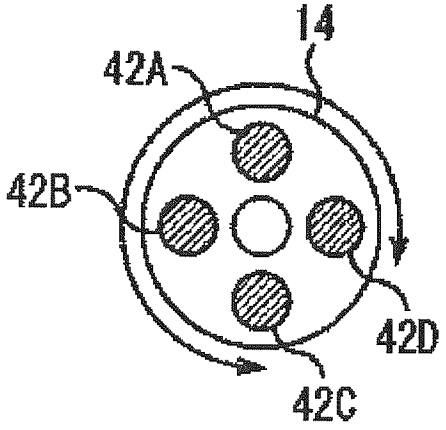
図７

【図８】
図8

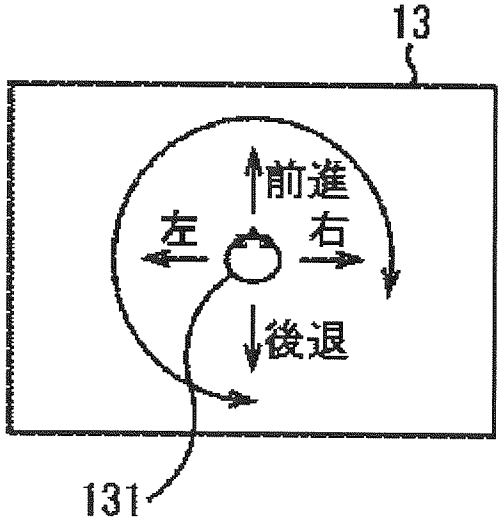

①
時計方向への回転が検出されたか？
S11
NO
YES
画面の中央を中心として
背景を反時計方向へ回転する
S12
画面の中央を中心として
背景を時計方向へ回転する
S13
②

【図９】
図9

A



B



【図１０】

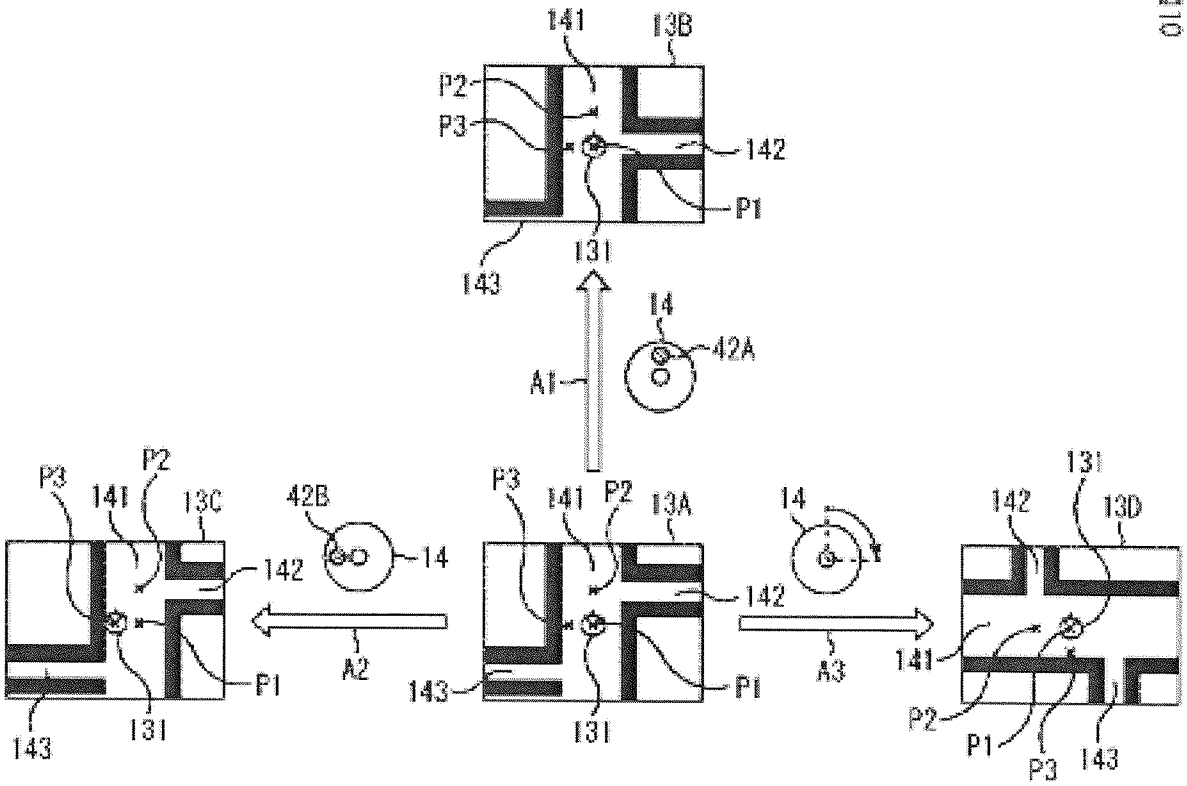
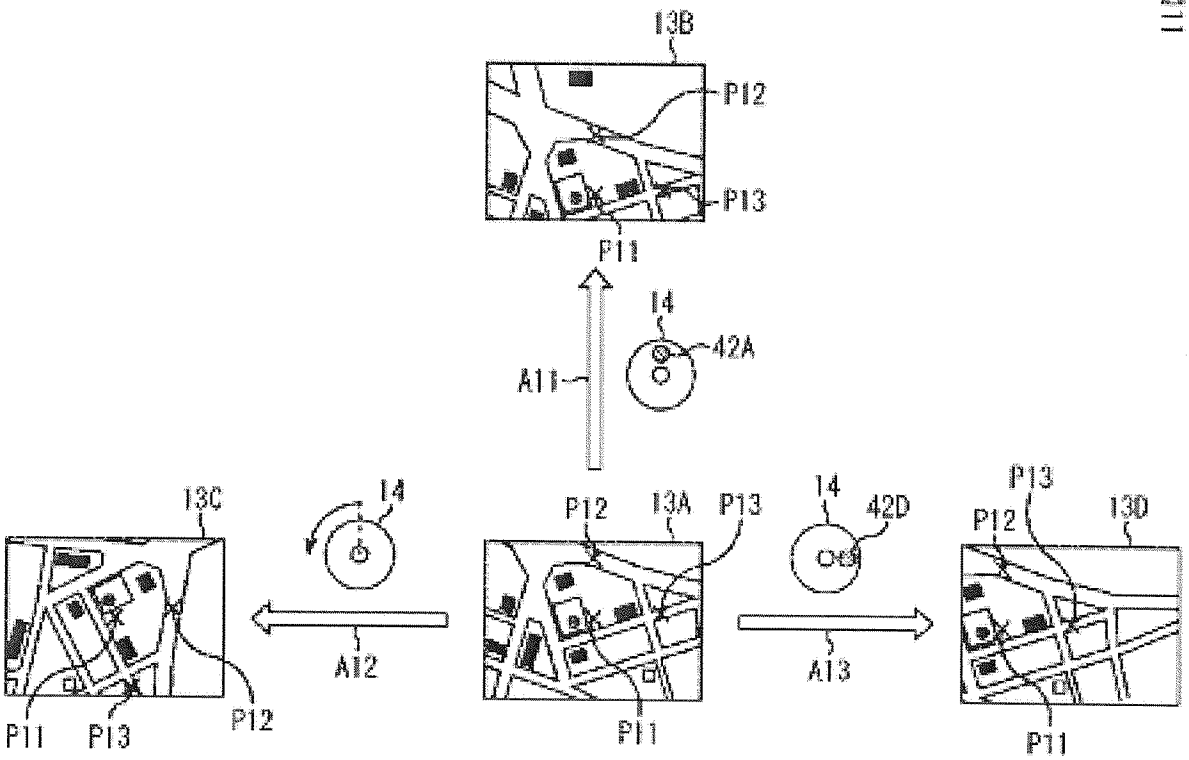

141
13B
P2
P3
142
P1
131
143
14
42A
A1
P3
P2
141
13C
42B
14
142
P1
A2
143
131
P3
141
P2
13A
14
142
P1
A3
143
131
131
142
13D
141
P2
P1
P3
143

図10

【図１１】


13B
P12
P13
P11
14
42A
A11
13C
14
P12
13A
P13
14
42D
P13
P12
13D
A12
A13
P11
P13
P12
P11
P11

【図１２】

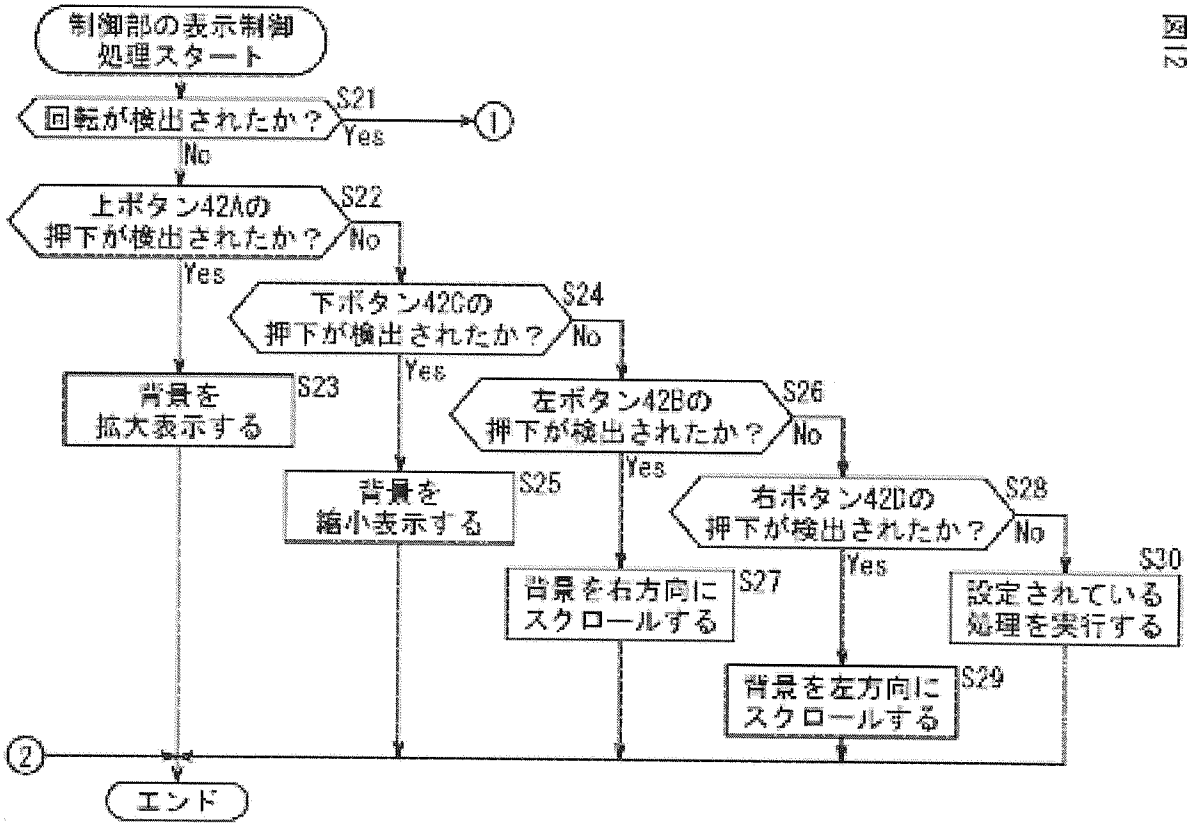
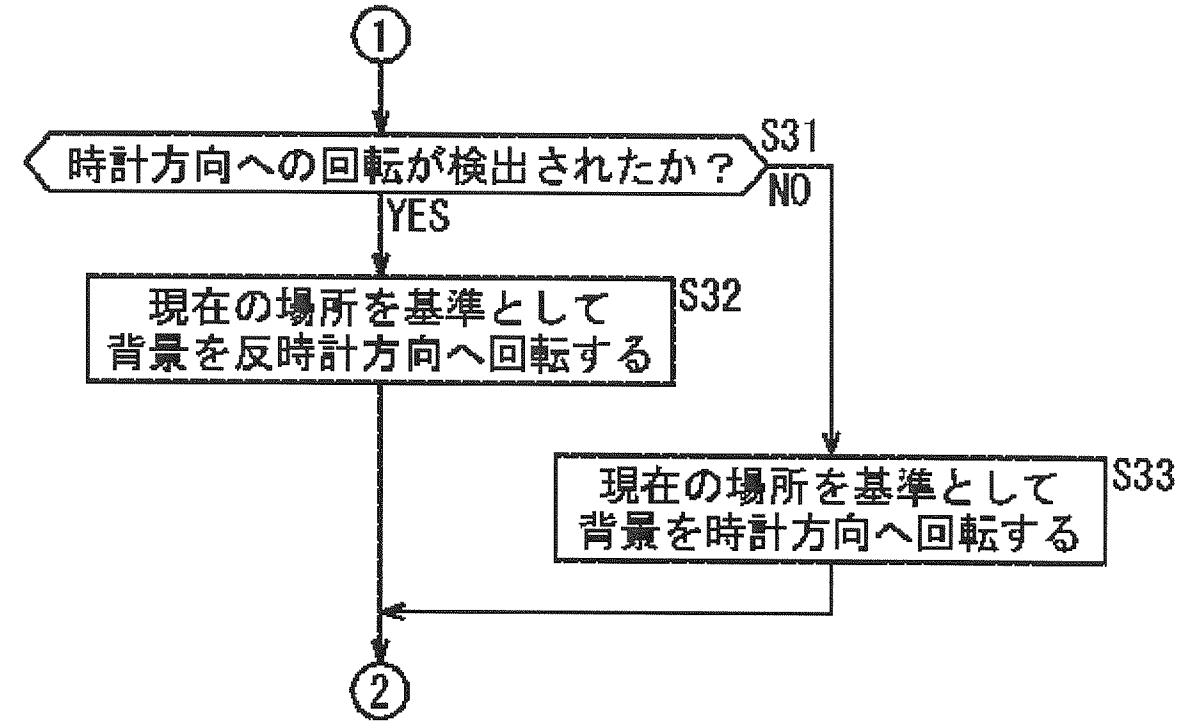
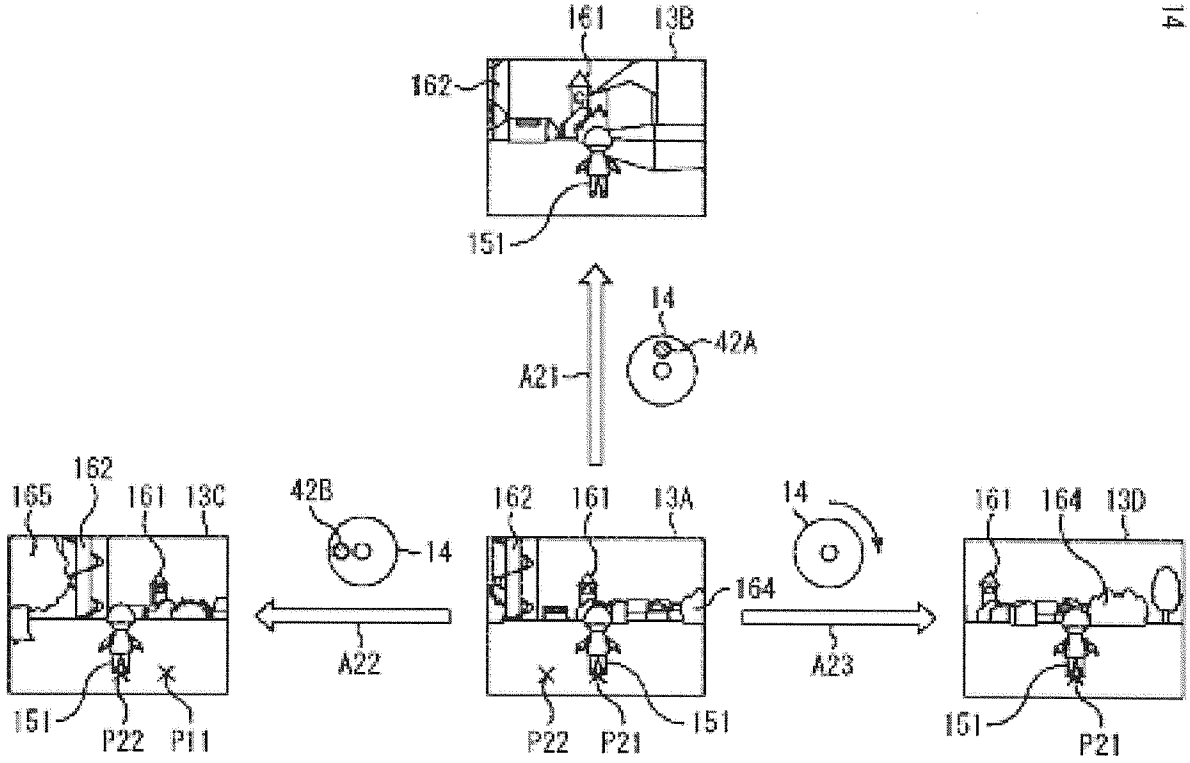

制御部の表示制御処理スタート
回転が検出されたか？
S21
Yes
No
①
上ボタン42Aの押下が検出されたか？
S22
No
Yes
下ボタン42Cの押下が検出されたか？
S24
No
Yes
背景を拡大表示する
S23
背景を縮小表示する
S25
左ボタン42Bの押下が検出されたか？
S26
No
Yes
右ボタン42Dの押下が検出されたか？
S28
No
Yes
背景を右方向にスクロールする
S27
背景を左方向にスクロールする
S29
設定されている処理を実行する
S30
②
エンド

図12

【図１３】
図13


①
時計方向への回転が検出されたか？
S31
NO
YES
現在の場所を基準として
背景を反時計方向へ回転する
S32
現在の場所を基準として
背景を時計方向へ回転する
S33
②

【図１４】


161
13B
162
151
14
42A
A21
162
165
161
13C
42B
14
A22
162
161
13A
164
14
A23
161
164
13D
151
P22
P11
P22
P21
151
151
P21

【図１５】

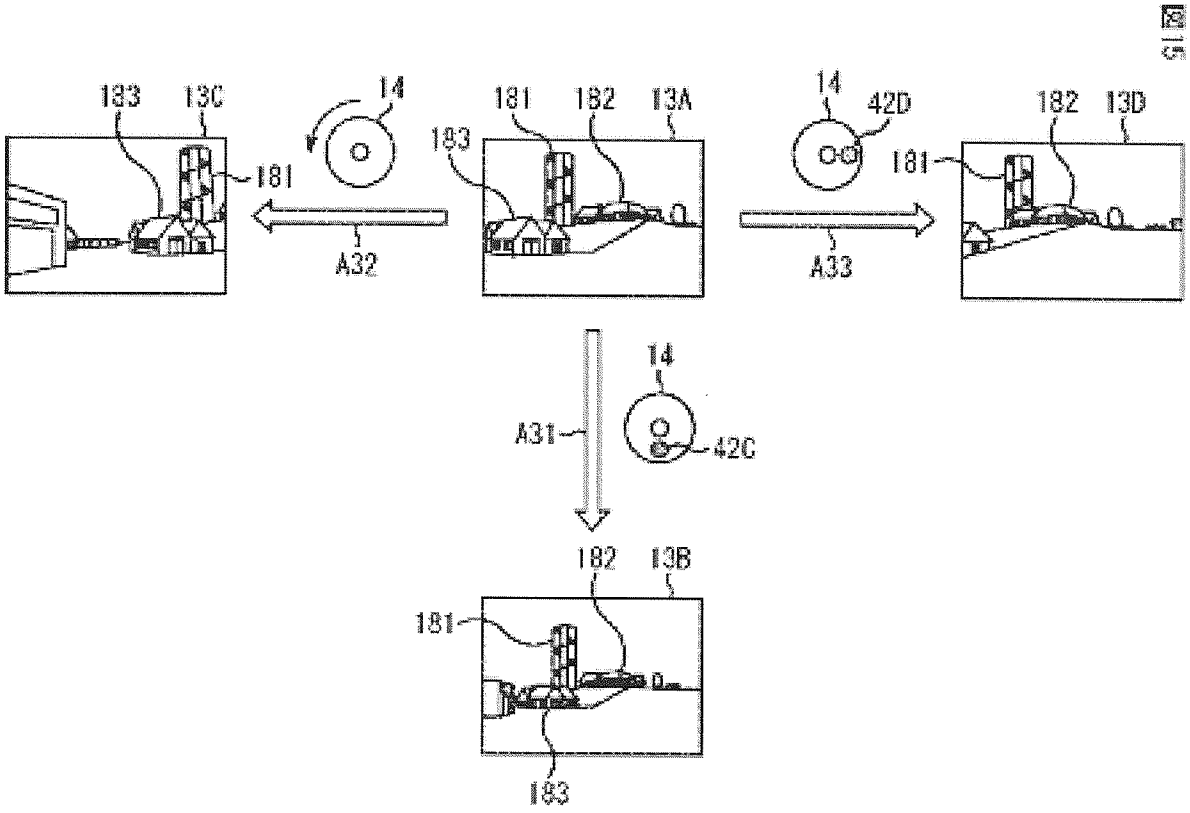


図15
183
13C
14
181
A32
181
182
13A
183
14
42D
182
13D
181
A33
14
A31
42C
182
13B
181
183

【図１６】

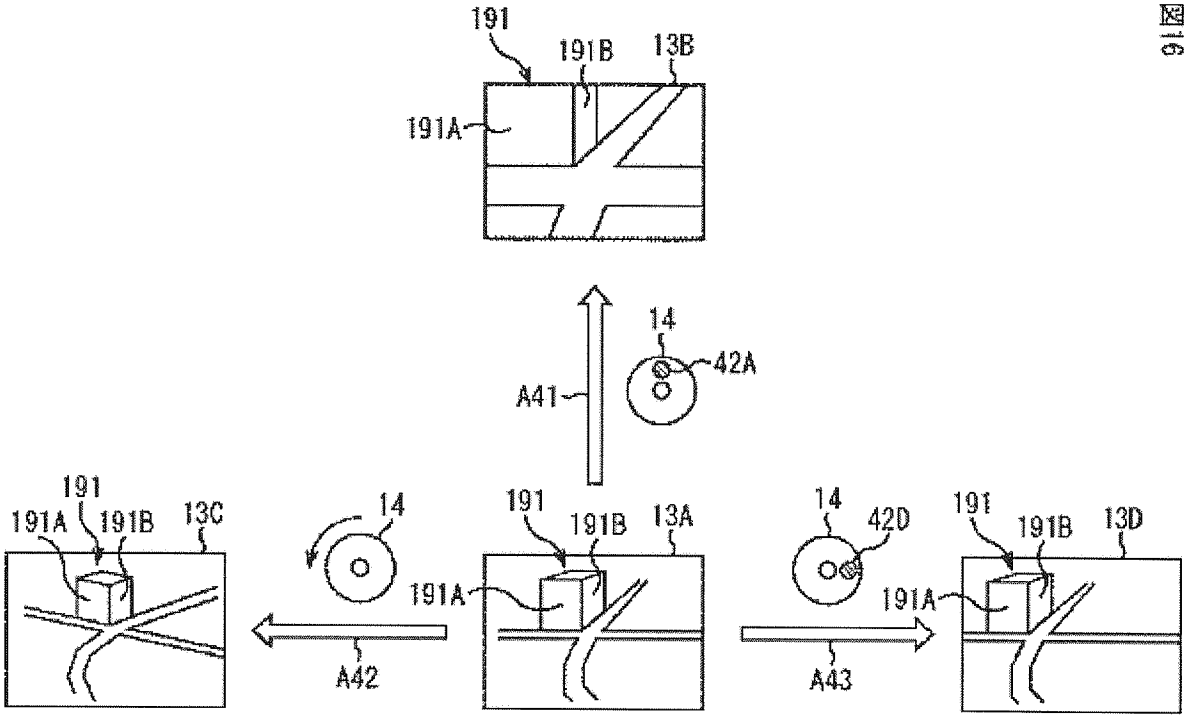

191
191B
13B
191A
14
42A
A41
191
191A
191B
13C
14
191
191B
13A
191A
A42
14
42D
191
191B
13D
191A
A43

図16

【書類名】図面　　[DOCUMENT NAME] DRAWINGS

【図１】　FIGURE 1

1	Mobile phone
１１	Antenna
１２	Speaker
１３	Display section
１４	Rotation input section
１７	Numerical keypad
１８	Microphone

【図２】　FIGURE 2

(上)	Upper
(左)	Left
(下)	Lower
(右)	Right

【図３】　FIGURE 3

【図４】　FIGURE 4

【図５】　FIGURE 5

【図６】　FIGURE 6

１１	Antenna
１２	Speaker
１３	Display section
１４	Rotation input section
１７	Numerical keypad
１８	Microphone
１１１	Control section
１１２	RF section
１１４	Voice codec

１１５	Input detection section
１１６	Input detection section
１１７	Memory
１２１	Rotation detection section
１２２	Press detection section
２１０	Drive

【図７】 FIGURE 7

Ｓ１	Rotation detected?
Ｓ２	Press of upper button 42A detected?
Ｓ３	Scroll Background downward
Ｓ４	Press of Lower button 42C detected?
Ｓ５	Scroll Background upward
Ｓ６	Press of left button 42B detected?
Ｓ７	Scroll background to right
Ｓ８	Press of right button 42D detected?
Ｓ９	Scroll background to left
Ｓ１０	Perform set processing
制御部の表示制御処理スタート	Start of display control processing of control section
エンド	End

【図８】 FIGURE 8

Ｓ１１	Rotation in clockwise direction detected?
Ｓ１２	Rotate background in counterclockwise direction about center of screen
Ｓ１３	Rotate background in clockwise direction about center of screen

【図９】 FIGURE 9

前進	Proceed

左	Left
右	Right
後退	Recede

【図１０】 FIGURE 10

【図１１】 FIGURE 11

【図１２】 FIGURE 12

Ｓ２１	Rotation detected?
Ｓ２２	Press of upper button 42A detected?
Ｓ２３	Scale up and display background
Ｓ２４	Press of lower button 42C detected?
Ｓ２５	Scale down and display background
Ｓ２６	Press of left button 42B detected?
Ｓ２７	Scroll background to right
Ｓ２８	Press of right button 42D detected?
Ｓ２９	Scroll background to left
Ｓ３０	Perform set processing
制御部の表示制御処理スタート	Start of display control processing of control section
エンド	End

【図１３】 FIGURE 13

Ｓ３１	Rotation in clockwise direction detected?
Ｓ３２	Rotate background in counterclockwise direction relative to current position
Ｓ３３	Rotate background in clockwise direction relative to current position

【図１４】 FIGURE 14

【図１５】　FIGURE 15

【図１６】　FIGURE 16

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[NAME OF DOCUMENT] ABSTRACT

[SUMMARY]

[OBJECT]

To make various operations more comfortable.

[MEANS FOR SOLVING]

A rotation input section 14 is provided substantially at a center of a mobile phone 1. When the rotation input section 14 is rotated in a clockwise direction or a counterclockwise direction, an image displayed on a display section 13 is rotated and displayed as shown by outline arrows. In addition, when up, down, left, of right of the rotation input section 14 is pressed in an inner direction of the mobile phone 1, a display range of the image displayed on the display section 13 in switched. For example, in a case where a map is displayed, the map is rotated when the rotation input section 14 is rotated, and the map is scaled up/down when a predetermined position of the mobile phone 1 is pressed. The present invention can be applied to mobile phones.

[SELECTED DRAWING] Figure 1